

What is claimed:

1. A dielectric layer disposed on the surface of a substrate, the dielectric layer having a top surface, wherein the dielectric layer comprises a first dielectric gradient region in which a dielectric constant  $k$  decreases continuously from a maximum value to a minimum value with distance from the substrate surface.
2. The dielectric layer according to claim 1 wherein an instantaneous rate of decrease of  $k$  in the first dielectric gradient region is between 0.025 and 0.5 per 10 nm of the dielectric thickness at substantially every location throughout the first dielectric gradient region.
3. The dielectric layer according to claim 1 wherein an instantaneous rate of decrease of  $k$  in the first dielectric gradient region is between 0.05 and 0.1 per 10 nm of the dielectric thickness at substantially every location throughout the first dielectric gradient region.
4. The dielectric layer according to claim 1 wherein the minimum value of  $k$  in the first dielectric gradient region represents a reduction of at least 0.2 relative to the maximum value.
5. The dielectric layer according to claim 1 wherein the minimum value of  $k$  in the first dielectric gradient region represents a reduction of at least 0.5 relative to the maximum value.
6. The dielectric layer according to claim 1 wherein the instantaneous rate of decrease of  $k$  in the first dielectric gradient region varies linearly with distance from the substrate surface.
7. The dielectric layer according to claim 1 wherein the instantaneous rate of decrease of  $k$  in the first dielectric gradient region varies nonlinearly with distance from the substrate surface.

8. The dielectric layer according to claim 1 wherein the first dielectric gradient region is adjacent the substrate surface.
9. The dielectric layer according to claim 1 wherein the first dielectric gradient region is not adjacent the substrate surface, the dielectric layer further comprising an initial dielectric region bounded by the substrate surface and the first dielectric gradient region.
10. The dielectric layer according to claim 1 wherein the first dielectric gradient region consists essentially of chemical vapor deposition products.
11. The dielectric layer according to claim 1 wherein the dielectric layer consists essentially of chemical vapor deposition products.
12. The dielectric layer according to claim 1 wherein the dielectric layer further comprises a second dielectric gradient region in which  $k$  increases continuously with distance from the substrate surface.
13. The dielectric layer according to claim 12 wherein the second dielectric gradient region forms the top surface of the dielectric layer.
14. The dielectric layer according to claim 12 wherein the dielectric layer further comprises a third dielectric gradient region in which  $k$  decreases continuously with distance from the substrate surface, the third dielectric gradient region being farther than the second dielectric gradient region from the substrate surface.
15. The dielectric layer according to claim 14 wherein the third dielectric gradient region is adjacent the second dielectric gradient region.

16. The dielectric layer according to claim 14 wherein the third dielectric gradient region is not adjacent the second dielectric gradient region, the dielectric layer further comprising an intermediate dielectric region bounded by the second dielectric gradient region and the third dielectric gradient region.

17. A semiconductor device comprising a dielectric layer according to claim 1.

18. A process of making a dielectric layer disposed on the surface of a substrate, the process comprising applying directly or indirectly to the substrate, under chemical vapor deposition conditions, a continuously varying composition of chemical vapor deposition precursors to form a first dielectric gradient region in which a dielectric constant  $k$  decreases continuously from a maximum value to a minimum value with distance from the substrate surface.

19. The process of claim 18 further comprising applying to the substrate an initial dielectric region and then applying the first dielectric gradient region to the substrate.

20. A process of making a semiconductor device that comprises a dielectric layer disposed on a surface of a substrate, the process comprising applying directly or indirectly to the substrate, under chemical vapor deposition conditions, a continuously varying composition of chemical vapor deposition precursors to form a first dielectric gradient region in which a dielectric constant  $k$  decreases continuously from a maximum value to a minimum value with distance from the substrate surface.

21. The process of claim 20 further comprising applying to the substrate an initial dielectric region and then applying the first dielectric gradient region to the substrate.